

## Mitigating distortion and residual stress by static thermal tensioning to improve fatigue crack growth performance of MIG AA5083 welds

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### Highlights

- Welding of thin section structures produces distortion and residual stress.
- Such problems can be controlled by static thermal tensioning.
- Static thermal tensioning can also improve weld fatigue performance.
- Fatigue crack growth behaviours due static thermal tensioning are discussed.

### Abstract

The demand for lightweight structures in ship fabrication to improve performance and fuel savings has led to increasing use of thin-section structures. However, welding such structures often produces problems such as distortion and residual stress. The present investigation is aimed to mitigate distortion and residual stress using static thermal tensioning (STT) to improve fatigue performance in AA 5083 metal inert gas (MIG) welded joints. The STT treatments were performed by cooling the weld zone and its adjacent area during welding whereas both sides away from the weld were heated at various temperatures of 100, 200 and 300 °C to generate thermal gradient. Subsequent experiments including distortion measurements, microscopical examination, hardness and tensile tests, measurements of residual stresses using neutron diffraction method and fatigue crack growth tests combined with SEM fractography were conducted. Results showed that an increase in heating temperature reduced convex longitudinal out of plane distortion. The minimum longitudinal out of plane distortion was achieved at a heating temperature of 200 °C owing to the balance between buckling distortion induced by welding and that generated by static differential heating which opposed the weld distortion. Under such condition, fatigue crack growth performance was improved.